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ABSTRACT

In recent years, higher education has been subject to the criticism that the pervasive lecture method is impersonal and ineffective. The individualization of instruction using instructional technology can help to answer that criticism by facilitating the optimal combination of professor-determined objectives and processes with student-determined needs and goals. New technologies and methodologies can be used to adapt the instructional process more precisely to the needs of students. Because there is a natural tension between student-determined objectives and those of the professor, it is important that any new system provide flexibility and choice so that institutional harmony can be preserved. (EMH)

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The Most Important Number is One

The Potential of Individualized Instruction in Higher Education

DONALD P. ELY

The J. Richard Street Lecture for the Centennial Year of Syracuse University 1970

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The J. Richard Street Lecture for the Centennial Year
of Syracuse University
1970

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The J. Richard Street Lectureship

The faculty of the School of Education at Syracuse University selects one of its own number to prepare an address to faculty, students, and visitors who attend educational conferences.

The lecture is named for the late Dr. J. Richard Street, who saw the need of a teachers college at Syracuse University. He prevailed upon Mrs. Russell Sage to provide a site, building, and endowment for the college, which was established in 1906. Dr. Street became the first Dean of this unit, which later was reorganized into the present all-University School of Education.

In 1941 the lectureship was endowed by his son, Dr. W. Walter Street, an alumnus of the University, who is a practicing physician in the city of Syracuse and Professor of Clinical Medicine in the College of Medicine, State University of New York, Upstate Medical Center.

THE MOST IMPORTANT NUMBER IS ONE

In the world today there appears to be a consensus that the traditional system of higher education does not meet the needs of an ever changing society. Most students feel that they are not receiving as good an education as they might reasonably expect. Faculty members feel the simultaneous pull of research and teaching. The anxiety created by this tension cannot be resolved according to traditional academic procedures. That this is a time of change is a truism; that this is a time of revolution is a statement of fact. From such truisms and statements of fact must come the design for a new order in American higher education.

Reasons for Discontent

"I am a human being. Do not fold, spindle or mutilate" may well become the student's battle cry for the rest of the century and into the next. The press of enrollments has created the mass education syndrome which results in a deceivingly simple solution—large classes. The unfortunate logic of placing more students in one room with a professor or of distributing that professor to smaller groups in many places through closed circuit television has only accentuated the magnitude of the higher education enterprise. Where it has been possible to hire more professors, the information dispensing model has persisted and the student is usually no better off than in the large lecture hall. From the solitude of the large lecture class stems the first irritant of discontent and the student wonders if there isn't a better way.

If the student persists in his academic career, he may eventually find his way into an occasional smaller class, perhaps with a senior professor. It is then he discovers that the professor is not always there because of demands in other parts of the nation or world. The professor defends his peripatetic activities by indicating that they contribute practical illustrations for his teaching and that, in the end, the students profit from his wanderings. While this absence is tolerated by the students, it raises some concern about their worth in relation to the calls of government and industry.

The tolerance for solitude and for the invisible professor can be accepted but the excuses for marginal teaching cannot be. The student who is subjected to hour upon hour and semester upon semester of passively observing professors' information dispensing behaviors begins to ask if there isn't an alternate route to a higher education.

The crowning blow comes when the student realizes that there are specific requirements which he must fulfill in order to receive a degree. It may be that the requirements are philosophically sound but the student is rarely informed about the rationale for these requirements. Degree requirements are defined in credit hours, not in terms of learning or mastery. Courses in specific disciplines are specified because they always have been. Little leeway is permitted in fulfilling these requirements regardless of the preparation which the student may bring with him.

It is little wonder that the voices of students are being raised in protest about the way in which they are being treated. The perpetuation of the normal *modus operandi* is viewed as unnecessary control. Many undergraduates are the products of elementary and secondary schools which have adopted new goals, new teaching strategies, new technologies and new freedoms for the learner. The student revolt in the 1960's has been attributed, at least in part, to the isolation of students from their professors and archaic requirements which continue without clear purpose or reason.

Signs of Reform

The clamor of dissatisfaction has stimulated some activity. Experimental colleges and honors programs have relaxed requirements in some higher institutions. Cluster colleges have recreated the small college within the larger university. Internships and field work in governmental agencies, industry, community service organizations and overseas have helped students to relate the theory of the classroom to practical affairs of society. New ways of examining competencies without the threat of examinations and scaled grades have eliminated the pointless process of professor-student psychoanalysis. Advanced placement and equivalency options have helped to avoid needless repetition of content already acquired. These beginnings, however small and infrequent, are signs of hope in the tradition-bound arena of higher education.

Oneness

Behind the problems which tend to give rise to the protests is the lonely voice in the crowd saying, "I am an individual. I am unique. I am one." The minor reforms which have been instituted are replys to the plea: "Let me control my own destiny. Free me to seek that knowledge which will be useful to me." This is clearly a time in higher education when the most important number is one.

The most important number is one. This premise has spawned one of the most important new developments in education today—individualized instruction. From the pioneering efforts of elementary and secondary schools across the country has come the concept of individualization. From a time when education was asked to provide "the greatest good for the greatest number" we have moved to the current focus on "the best for each." For decades educators have talked about individual differences without much difference being displayed in classroom practice.

Why individualization? Why the best for each? Why is one the most important number? Because each person in this nation has the right to pursue life, liberty and happiness to the fullest extent possible. To achieve personal uniqueness in this pursuit, teachers and learners must first take charge of their own lives and develop them to the fullest. It means that each individual should be able to run his own life and not have it run by others. The complete individual is one who has his own sense of power, his own uniqueness, his own sense of indispensability. If a person fails to develop his individuality he will become either apathetic or rebellious. Apathetic persons accomplish nothing. People who believe in nothing change nothing. Rebellious persons may bring about visible but superficial changes. Neither state is desirable.

Definitions

Before probing the ramifications of oneness, it is necessary to define two terms which come from the same root but which connote different concepts: individual differences and individuality.

According to Green (1970) "when we speak of individual differences we are speaking of distinct properties that belong to different individuals." If we look at the properties which any one person possesses we discover that he has certain common properties which he shares with other persons but that he also has properties or

characteristics which distinguishes him from other people. In this sense each person is numerically distinct from other persons. These distinguishing factors alone have no direct implications for education until the goals and objectives of education are defined. (Weaver, 1970)

Individuality, on the other hand, is concerned with autonomy. Weaver (1970) stresses that individuality is "more than distinctness of one trait. We mean that it is the result of unique actions of a person." He quotes Green (1970) by saying ". . . that such a description allows us to 'draw a kind of crude, but important distinction, between those things that *I* do, think, believe, learn, and those things that are done *to* me or *upon* me'." Therefore, Weaver argues, "Questions of individual differences deal with distinguishing properties. Questions of individuality can be answered only by sets of acts or the results of sets of acts."

Approaches to Individualized Instruction

The distinctions between individual differences and individuality preclude the use of the term individualized instruction in all but the most general circumstances. Two major components are required to help establish adequate definitions of the various types of individualized instruction: Objectives and Means (after Edling, 1970). Placing objectives on the horizontal axis and indicating whether they are instructor determined or learner determined and placing the means on the vertical axis and indicating whether they are instructor determined or learner determined, yields four distinct approaches to the individualization of instruction. (Figure 1)

		OBJECTIVES	
		Instructor Determined	Learner Determined
MEANS	Instructor Determined	I	III
	Learner Determined	II	IV

FIGURE 1 *Approaches to Individualized Instruction (after Edling, 1970)*

In *Type I*, the instructor states specific objectives which he expects the learner to attain. He also specifies the media which will be used and the methods which will be followed to achieve the specified objectives. As with all types of individualized instruction, the pace is determined by the student.

The instructor states the objectives for *Type II* but the learner is provided access to a wide variety of learning resources and is given virtually no direction by the instructor. He is expected to achieve the objectives using his own strategies and the resources available.

When the learner states the objectives he is seeking and the instructor provides rather specific assistance in selecting appropriate media and methods, *Type III* is described.

Type IV could be called independent study since the learner determines both the objectives and the means for achieving them.

A classification scheme serves primarily as a guideline for looking at various types of programs which are labelled individualized instruction. While the categories are distinct, there is no need to select one approach while excluding all others. Selection of the appropriate type is determined partially by the goals of the curriculum in which the instructor and learner are integral parts. Sometimes the entering behavior of the learner dictates the type of individualized instruction which will be followed. For example, a professor of economics might want a student to be able to use statistics as a tool in economic analysis but the student is unable to do so. He could specify a programmed textbook which would lead the learner to this competency. (Type I). The same professor may want the student to write a comparative analysis of gross national products in three Latin American nations. The student would then seek out the best references available and fulfill the assignment by his own self direction. (Type II) The student might select a topic for a term paper and seek out the professor for recommended resources and for assistance in the design of his study. (Type III) This is a personalized approach to individualized instruction. Independent study (Type IV) would find the student stating his objectives and seeking his own sources of information. One of the sources might be his professor but, in this case, the professor would be nondirective in his assistance.

Concept of Control

There have been other attempts to classify individualized instruction which use the same control variables. McClellan's (1970) interpretation is that, "given a population of students and specified objectives of instruction, the instruction itself is to be specifically directed toward each individual student rather than toward the population as a whole or toward any subdivision of the population larger than one." In contrast, the other category according to McClellan: "Given a population of students and a batch of available instructional techniques, the objectives of instruction are to be specified by each individual student." In discussing the concept of control over the conditions of learning, Weaver (1970) distinguishes between specified goals and means with the teacher as a control element, which he calls *didactic,* and with the student as a control element which he calls *heuristic.* (See Figure 2) In the didactic (teacher controlled) situation, "The process is 'rational,' i.e., objectives and means are clear, and are preconceived, and controlled by the teacher." "If the learner controls process and means-end are preconceived, then the mode might be called *heuristic.* Heuristic or independent learning is rational to the extent that goals, and means to accomplish them, are preconceived and such goals are clear. In the inductive or discovery process the learner has preconceived some outcomes and means as expressed in his hypothesis and research design." (Weaver, 1970)

The Danger of Extremes

In higher education today it is often necessary for students to achieve objectives which have been determined by the instructor, primarily in the acquisition of tools—terms, concepts, techniques, and literature in any given field. They also will pursue self-generated objectives. Students are demanding more and more that they be able to make their own decisions about objectives they wish to pursue. Both sources of objectives are legitimate and must be honored. The balance in which they operate is often a point of contention and is yet further evidence of individual assertion. The extreme positions of instructor determined or student determined objectives give rise to some of the confrontations which are becoming more and more commonplace.

	GOALS AND MEANS
Instructor	DIDACTIC
Student	HEURISTIC

FIGURE 2 *Concept of Control (After Weaver, 1970)*

We must be alert to the extremes in our world, whether they refer to determining educational objectives or political positions. In a changing society and a changing world, the simple black or white solutions are very often not tenable. There are very few black or white situations anymore. There are many shades of grey inbetween. It is not yet clear what the world is becoming but it is "in process." Our stance must also be "in process" and our statements should be tentatively held hypotheses. Go or no-go may be the fundamental basis of computer operations, but with human beings it is the "perhaps" phenomenon which must be honored. If there is any position which arouses the ire of a human being, it is another human being making blanket statements of fact about the human condition, the social or political climate, or the objectives of education. We should not be trapped into dichotomies. Polarization is a means to a self-defeating end. One of the most suspect words in the English language may be the word "is".

On Goals and Objectives

Teachers and learners must constantly strive to distinguish between goals and objectives. Goals are those statements which provide general direction. They tend to be global and all-encompassing. The rhetoric of goal statements on the first page of college catalogs is well known. While goals tend to be imprecise, as compared with objectives, they map out the area in which we want to be. Objectives define, rather precisely, the behaviors we want to acquire or want students to acquire.

What goals are we seeking in education today? John Gardner (1963) says: "The ultimate goal of the educational system is to shift to the individual the burden of pursuing his own education." To achieve this goal, which is probably the direction in which we want to go, requires knowledge upon which to act; sensitivity to other human beings; and skills which permit the knowledge to be applied in an environment of openness and receptivity.

It is out of wide knowledge that we develop the ability to make good choices. The truest freedom of the human race is the freedom of choice. But we cannot choose something of which we have never heard. Call it knowledge, ideas, concepts, content or facts—this is the stuff of education which gives us control over our own destiny. With its acquisition comes the realization that we possess the tools to become the self-motivated learner. More and more we are becoming aware of another kind of tool—sensitivity to others.

In most of our educational programs we have been more concerned about the minds of students rather than about their hearts, more concerned with their intellect than with their emotions. Edgar Dale (1970a) says that "We examine intellectual growth more than we examine growth in values. We have emphasized what students *know* but underemphasized a concern for what they deeply *care* about, their attitude toward life, their zest for living. . . . The danger of assuming a coldly intellectual stance is that we may then see teachers and students only as *brains,* as purveyors and receivers of facts, but not as living, breathing persons. The intellectually oriented person may teach what he *knows* (and this may be a lot), but he may fail to teach what he *is.*"

Perhaps the *Wizard of Oz* best sums up what individuals are seeking in this milieu we call education:

> "I don't know enough," replied the Scarecrow cheerfully. "My head is stuffed with straw, you know, and that is why I am going to Oz to ask him for some brains."
>
> "Oh, I see," said the Tin Woodman.
>
> "But, after all, brains are not the best things in the world."
>
> "Have you any?" inquired the Scarecrow.
>
> "No, my head is quite empty," answered the Woodman, "but once I had brains, and a heart also; so, having tried them both, I should much rather have a heart."

As the goals of education are periodically reassessed, by teachers and students, as they ought to be, there should be a concern for both the broad intellectual base which permits individuals to function as generalists and the capacity to use one's inner resources to function as human beings. If this balance can be maintained, individuals should be able to cope with the unpredictable changes of a complex world.

Achieving the Goal Through Instructional Technology

If we can accept John Gardner's proposed goal that: "The ultimate goal of the educational system is to shift to the individual the burden of pursuing his own education," perhaps we can call upon this same eloquent spokesman to recommend the means. In a speech before the National Committee for Support of the Public Schools John Gardner (1970) said ". . . judicious use of videotape, programmed instruction, computer-assisted instruction and other new approaches holds promise of a truly immense gain in the availability of the highest quality instruction—instruction that can be individualized, motivating, powerful in impact and grounded in the best teaching practices. . . . It is in my opinion the *only* hope for a radical upgrading of educational quality on a massive scale." The paradox of Gardner's support is that the very technology which has given rise to some of the problems facing American education offers potential for solving some of the same problems.

Instructional technology, often viewed as the depersonalization of the educational process, is beginning to be discovered as a viable resolution to some instructional problems. The President's Commission on Instructional Technology (1970) states the case well:

> The aim of all these innovations—organizational, curricular, and technological—is to adapt instruction more precisely to the needs of each individual student.

But the goal of individualized instruction is not being met in most of the nation's schools because of lock-stop programs:

> Many people who have no aversion to organizing instruction scientifically and to bringing new technology into the schools and colleges fail to realize that the present system is in many respects mechanical and rigid. The vast differ-

> ences in the ways students learn are disregarded when they are taught the same thing, in the same way, at the same time.

There is an obvious corollary—the vast differences in the way students learn can be dealt with, accommodated and even enhanced through individualized instruction designed by the principles of instructional technology.

Definition of Instructional Technology

It is important to clarify the definition of instructional technology since it is currently used in two distinct senses. In its more familiar usage, instructional technology refers to the products stemming from the communications revolution. In this sense the media and machines are viewed as adjuncts to the instructional process with emphasis on the effects of devices and procedures on learners. Common descriptors of this definition include motion picture projectors, tape recorders, television, computers and other types of media and machines.

The second definition is emerging as a result of influence from the behavioral sciences. The definition upon which the remainder of this paper is based is less frequently used. The new definition of insrtuctional technology studies objectives and the "mix" of man, machines, media and methods to help different learners achieve mastery of the content and processes of instruction. The definition offered by the Commission in Instructional Technology (1970) is quite acceptable in this sense.

> (Instructional technology) is a systematic way of designing, carrying out, and evaluating the total process of learning and teaching in terms of specific objectives, based on research in human learning and communication, and employing a combination of human and nonhuman resources to bring about more effective instruction.

The word "technology" (from the Latin, *texere*, to weave or construct) does not necessarily imply the use of machines but refers to the practical application of scientific knowledge. Jacques Ellul, the French sociologist, says that "it is the machine which is now entirely dependent upon technique, and the machine represents only a small part of technique." (1964) Therefore, in this discussion, instructional technology is more than the sum of its parts. Machines are only part of the larger concept which we call technology.

Instructional technology in this sense offers the potential for solving some of the teaching and learning problems which confront American higher education. The process of instructional technology permits college professors to take a new look at what they are doing in the classroom, why they are doing it, the means for attaining the outcomes they are seeking for their students and instruments which indicate when they have succeeded.

The way of instructional technology is not one way—it offers a series of alternatives—but the process almost always begins with a statement of the behaviors which learners ought to be able to demonstrate when competency is reached. Glaser (1965) summarizes the process of instructional design as follows:

> (a) the setting of instructional goals will be recast in terms of observable and measurable student behavior including achievements, attitudes, motivations, and interests; (b) the diagnosis of the learner's strengths and weaknesses prior to instruction will become a more definitive process so that it can aid in guiding the student along a curriculum specially suited to him; (c) the techniques and materials employed by the teacher will undergo significant change; and (d) the ways in which the outcomes of education are assessed, both for student evaluation and curriculum improvement, will receive increasingly more attention.

The instructional technologist who operates in this fashion is an instructional designer—a curriculum specialist. There is no other professional in higher education whose responsibilities come as close to the curriculum specialist in the elementary and secondary schools. While instructional technologists with behavioral science orientations are uncommon in higher education today, they do exist. They are making significant impacts on instruction and they are being actively sought. Within the next decade, it is likely that every institution of higher education will employ at least one instructional technologist and more likely a team of such professionals whose major responsibility will be to assist in the design of instruction for the purpose of improving teaching and learning.

Further, the instructional designs emerging from the relationship between the professor and the instructional technologist will be, for the most part, individualized instructional modules. The process of individualized instruction which permeated the elementary and secondary school systems of the United States in the late 1960's

must gain a significant position in the colleges and universities during the decade of the 1970's if they are to meet the challenge of the emerging new era.

Individualized Instruction in Higher Education

There has always been some type of individualized instruction available to the college student. From the Socratic model to the Oxbridge tutorial, the student-professor relationship has been the highest relationship to which both aspire. The assumption is that the smaller the number of students, the more ideal the climate for learning. If a one-to-one relationship is possible, so much the better. The fallacy of this argument is that quality is measured by student-professor ratios but not by the motivations of either, nor the competencies, nor the availability of other learning resources. The entire body of research relating to class size in higher education does not reveal any optimal number for maximum learning. The burden of proof is on the professor whose knowledge, personality, speaking voice, design of class time, and rapport with students creates more variables than measures of effective student-faculty ratios could possibly yield.

Again, it must be pointed out that there is danger in the either/or dichotomies; the black or white situations. The matter we have been discussing is not a question of large classes vs small classes, or classes vs individualized instruction. We are not trying to replace all teaching functions with machines nor are we willing to accept one hundred percent lecture time by the professor. We are seeking to discover the best combinations of professor's time, self-instruction time, and discussion time for specified instructional objectives.

Professor Generated Objectives

The concepts of instructional technology offer the best approach to the individualization of instruction in higher education. The starting point must be designation of the type of individualization. Will the *objectives* be determined by the professor or by the student? Will the *means* for attaining the objectives be selected by the professor or by the student?

There will be times when the professor must specify the objectives and the means: when basic concepts must be mastered, when definitions, formulae, and standard procedures must be followed and when other kinds of tools are essential for problem solving and data analysis. These self-instructional modules are perhaps the easiest to develop. Objectives are stated; tests of entering behaviors are generated and validated; media and materials are selected or produced; procedures are spelled out; and criterion tests are prepared. The process is recycled as often as necessary with pilot groups before it is made available to large numbers of students.

This type of individualization is often criticized because of its apparent lack of human relationships. It should not permit depersonalization. Part of the design will include small and large group meetings when these are appropriate to the objectives. The design usually calls for tape recorded lectures by the professor in which he addresses the individual student, not the class as a whole. He is often present in the area where the programs are used as are his assistants. Someone is always present. He might offer telephone hours when students are encouraged to call him and raise pertinent questions. Professors and students who have used self-instruction modules report a closer identification with each other. The apparent disadvantage can be turned to an advantage.

The professor might specify the objectives but permit the student to select the means for attaining them. After basic tool competencies are acquired, issues may be identified and researchable questions may be raised by the professor. The student is then free to seek out the resources which will help him to achieve the desired outcomes. It is in this mode that the concept of *access* is paramount. The student should have access to a wide variety of learning resources. The library has traditionally been the prime focus of research activity. But a new concept of library as a function, not a place, must be adopted. A collection of films, recordings, and microforms adds dimension to the contemporary library. The availability of computer programs and data processing equipment allows the student to search for new relationships once basic information has been collected. Laboratory space for individual scientific explorations rather than exercises should be accessible. Beyond the walls of the university is an untapped classroom—the World. Modern technology provides the means for getting there. Once there the student may use cameras and tape recorders to capture the information he needs to help attain his objectives. Technology provides electronic or

mechanical means for arresting, processing and reconstituting visual or verbal information. Current educational terminology would call this approach "inquiry" or "discovery;" an earlier label was "inductive." The product of this effort should be closely related to the objectives even though the means for attaining the outcomes would probably vary from person to person.

Student Generated Objectives

Both types of individualized instruction just discussed depend upon professor designated objectives. These types of objectives are valid and will continue to be necessary in higher education. But the emergence of student determined objectives, originally confined to the advanced graduate levels, are beginning to appear. More independent study projects are being noted. The January semester in the institutions which have adopted this interim term, is almost entirely focussed on student stated objectives. More research appointments for undergraduates and early graduates point up opportunities for student determined objectives. It is clear that in this era of student participation in nearly every facet of higher education that they will demand and will receive the right to make their own decisions about the objectives they wish to pursue. McClellan (1970) says, "It follows that when students choose their objectives, educators must increase the number of items in their batch of instructional techniques, else that freedom of choice of objectives doesn't mean very much." Current research indicates that when students have the opportunity to establish goals, they have a significant increase in achievement as compared to students who are working on goals which have been established for them. (Oakey, 1970)

The use of student established objectives is often called independent study. But, following the Edling matrix, there might be instructor selected means (as in a directed reading course) or there might be student selected means. When the instructor serves as originator of means, the student retains some of his dependency upon professional assistance. When the professor dispenses information which may or may not be used, he becomes one resource among all of the available resources—human and nonhuman. When a student establishes his own objectives he is exercising his individuality. When a student establishes his own objectives he is moving toward that goal

of pursuing his own education. It would seem that in our design for education in the future we ought to direct our efforts toward helping each person to choose his own objectives.

Means for Attaining Objectives

Whether we look at instructor selected or student determined objectives, we note that the means for attaining the objectives is often tied to a mediated format. If self-instructional modules are produced, it is highly likely that much of the instruction will be mediated. If the student is seeking means to attain instructor stated objectives, he will require a battery of resources if he is to secure all the information he requires. When the student prepares his own objectives, and goes to the professor to assist him in locating resources, he is, unfortunately, less likely to be steered to media resources. If he is completely on his own and a wide range of information is available to him in many formats, he will select those which are easiest for him to work with, those which match his learning style and those that will be consistent with his reporting format. It should be clear that, in any type of individualization, instructional technology plays a key role in the design. Media are integral parts of the strategy for attaining objectives regardless of who establishes the objective.

The creative use of instructional technology in the design of college teaching will help to alleviate many of the problems of teaching and learning. There are obvious advantages of individualized instruction for the student regardless of the origin of the objectives: (1) the learner moves at his own pace; (2) a wide range of learning resources insures a maximum "fit" between the learner and the materials; (3) a variety of learning styles can be accommodated; and (4) there is the opportunity for a greater intimacy between professor and student—a personalization of learning.

From the professor's standpoint there are likewise advantages: (1) if the bulk of the course is individualized, more time is available to work with individuals and small groups; (2) there is satisfaction in directly observing the results of the instructional effort; (3) more time will be available for reserach or off-campus consultation since much of the instruction will be prepared and longer absences will be permitted through this flexibility; (4) a team approach will let each individual professor do what he is able to do best.

Resolving the Problems Through Instructional Technology

While advantages of individualized instruction using the process of instructional technology are evident, there are other kinds of benefits which might help to focus attention on the individual—the most important number is one!

Since there is no relative advantage to large lecture classes, might it not be possible to abolish the large lecture sections and redesign the content for self instruction? In such a mode, students could come at the best time and stay as long as they wish. If the lectures were recorded on audio or video tape, the student could stop at any point, rewind, and listen again. No longer should professors spend class time giving factual information or attempting to discover what facts the students have accumulated. It will be possible for the students to acquire, outside of class, all the data necessary for mastering a given objective.

There are three basic questions which help the professor and the instructional technologist to determine the strategy for any given course. Once the objectives have been established, they may ask:

(1) Which objectives can be reached by the student on his own?

(2) Which objectives can be reached best by formal presentations by the professor or others?

(3) Which objectives require interaction between student and professor; between student and student?

Answers to these questions help to indicate how much of the course can be designed for self-instruction; how much for formal lectures; and how much for small group discussion with both faculty and student discussion leaders. In general, no one organizational pattern should be selected to the exclusion of all others.

In response to the problem of the absent professor it should be pointed out that individualized instruction allows professors to fulfill teaching assignments according to new time patterns. Without the Monday-Wednesday-Friday at 10:00 A.M. syndrome, time can be organized differently without losing identity with the students. Professors talk with students in the locale where the materials are used. Their assistants are always available and can perform a more satisfying role than the normal teaching assistant or laboratory

assistant. They hold usual office hours and may establish telephone hours as well. No student needs to feel removed when individualized instruction is used.

The discipline of course organization and objective specification is the first step to improved teaching. Just as courses which are prepared for television broadcasting tend to be compact, well-prepared and occasionally interesting, so should individualized instruction. Whether it be a program for a computer or the step-by-step instructions for procedures in a laboratory, the process must be completely thought out. There is little room for padding. Redundancy is not required. The usual result is a very tight learning module which helps the student to know where he is going, how to get there, and how to know when he has arrived. When it is formulated in the manner outlined, there is almost uniform agreement on the high quality of teaching and learning.

The problem of institutional requirements is of broader concern and is administrative in nature. However, we shall not avoid it since individualized instruction is also a possible solution to this problem. A college degree should reflect the individual's capacity to function as a responsible citizen, to make good use of his leisure time, and to continue learning. In a sense it is never possible to measure the attainment of these goals but we can focus on one fixed goal that can be evaluated: competence in a given field.

A major task for higher education is to abandon the credit hour system and make precisely clear what a student must achieve in growth of knowledge and intellectual competence to warrant the awarding of a degree. Evaluation should be made on the basis of the student's ability to organize knowledge, apply it to solving problems and growth in wisdom. The less tangible objectives relating to human relationships will be assessed as well, but in subtle ways. As higher education moves to the future, with the potential of individualized instruction through instructional technology, the college and university will give the student greater flexibility than ever before—flexibility in how he reaches an objective and how long he takes. But the student's objective will be much more clearly defined in terms of knowledge, competence in using this knowledge, human relationships, ability to demonstrate sensitivity to others, and maturity of judgment.

Commitments Required

There is no need to reinvent higher education. It already exists in many forms which are more and more accommodating to the individual needs of the citizenry. What is needed is a revolution in the traditional institutions and a reinstatement of the individual as the focal point of the enterprise. The students seem to be demanding it. Useful, working models now exist. Instructional technology provides the design factors. The results have been favorable where it has been tried. Beyond thse factors, what else is required?

The first requirement is a major commitment on the part of the faculty to change. This requires that teaching will be a dominant concern for the professor, at least during the period of instructional development. The professor has been characterized by the late David Boroff as liberal politically and conservative professionally. College teachers tend to continue teaching as they have taught. They are not prone to change. They follow the models of their own graduate school professors. There has to be a willingness to experiment, to try new approaches. They must view research on the teaching process itself as a viable area for study. They must be totally committed to the process while it is underway.

At the same time, the administration must support instructional development. Support comes from major policy statements regarding an emphasis on the improvement of teaching. Support comes when rewards are built into the system. Professors who are willing to change should be relieved of teaching some of their normal load during the experimental period. Full salary for summer work would be another indicator of support. Consideration for promotion should be based on the degree to which instructors have been actively involved in the process of teaching improvement. Financial support is vital. While it is possible to posit some gain in cost/effectiveness in the long term, there will be initial expense during early stages of development. Staff to support the process is imperative as are adequate facilities in which to operate. These are difficult specifications at a difficult time. The potential for rewards, however, is great. The benefactor of the entire effort is the student who remains at the center of the process.

Students must be willing to join the venture as co-sponsors of the research and development efforts. They must be willing to serve as subjects in experimental programs which might fail. They must be involved in the process. They must be willing to set their own

objectives and to assist in the evaluation. They will become teachers of other students and thus learn at the same time. They must be ready to learn and assume the role of the autonomous learners. "The autonomous learner," according to Carpenter (1968) "should require progressively less effort and reduced regulation by teachers and very different access to and assistance from technologies."

Finally, there must be access to information in a wide variety of formats to allow the student to pursue objectives on his own. Films and videotape of great men and important events provide data of a much different magnitude than a newspaper account or the synthesis in a book. Recorded sound, spoken voice and music, reconstitutes the past and gives the learner a right to interpret information for himself. The memory storage of computers provides instant retrieval of information in many fields. Slides, filmstrips, and other photographic reproductions offer still more additional information. The availability of self-instructional materials can be revolutionary. They can break the grip of inflexible requirements of time and place of instruction which now hold our colleges. The focus of attention is on the autonomous learner. There can be learning without teaching as there has been teaching without learning for a long time. If students learn well, they have been taught well—no matter who taught them or what instructional media were used.

Striking the Balance

The university of today and tomorrow is not as revolutionary as it may appear. In some ways we are returning to the original designs of a university as a place where the elite were prepared for the professions. The new elite, however, is all the people. In this country we are beginning to see the emergence of the individual and we are recognizing his right to the maximum amount of education which he can acquire. The new elite, the student everyman, comes to college having been profoundly affected by technology and the media of mass communication. In many cases his elementary and secondary education was infused with elements of media and technology. He arrives at college a product of mass culture. At the very point when he is seeking humanization and guidance toward a professional career, he is often processed into a mass education mold which is perceived as the ultimate blow to human dignity. Technology is there but it has followed the industrial model where machines help to increase the efficiency of the production line. The same applica-

tion cannot be used with people unless it is balanced with a humanizing dimension. Media are there but they follow the commercial model. Media, such as television, cannot be based on the model of the broadcast industry unless there is a counter-balancing factor of human interaction.

The point is that we have been highly successful in our society in managing almost every job which comes before us as a people. Someone solves it, usually with a technological dimension. When problems of greater enrollments encounter the university we attempt to transfer the production line model to the institution and the effect is usually negative. We have forgotten that the components of the system are people, not parts of a machine or a system which can be regulated. While we cannot recommend the removal of all data processing equipment, elevators in high rise dormitories and Centrex telephone systems, we can provide the opportunities for humans to relate to other humans thereby learning to live *with* technology, not *by* technology.

Edgar Dale (1970b) delineates the way in which people who are involved in the process of improving learning might serve:

> To cope with the complexities of communicating effectively we must create a new generation of message-makers who have mastered the science and art of instructional communication. These will include persons described as educational designers, instructional technologists, media specialists. They will know how to communicate by varied media: reading and writing, speaking and listening, visualizing and observing. They will understand how best to use the instructional power of the still and the moving image, of drama, fine arts, radio, television, exhibits, the museum.
>
> What then might the role of the future teacher be? I see this teacher as a learning coach, as an organizer, manager and creator of learning experiences, as a sensitive diagnostician of the needs of students, a compassionate mentor. I see teachers committed to motivating students to learn how to learn and to develop a zest for learning. I see a shift in emphasis from the lower mental processes of uncritical memorizing to a concern with developing the creative, thoughtful, sensitive learner.

The most important number is one. Individualized instruction is suited to the individuality of each person. With this concern paramount we must be certain that an appropriate balance is struck between the content to be learned and the process to be followed in dealing with fellow human beings.

Virgil said, "Many of these things I saw, and some of them I was." Students want to know what their professor sees but they also want the kind of communication that comes from knowing what he is.

> Whitman wrote, "There was a child went forth every day:
> And the first object he look'd upon, that object he became;
>
> And that object became part of him for the day, or a certain part of the day, or for many years, or stretching cycles of years."

Teachers should establish the conditions and provide the objects in which each student might experience the dynamics of the discipline—the vital elements of the field in which real people have real feelings about real events and objects.

The thrust of this presentation is best summarized by an eloquent statement from the Report of the Commission on Instructional Technology (1970):

> Freedom and self-direction have always been accepted as goals of American education. The use of technology in education can increase the alternatives and permit the student to find his own direction more easily. The pluralism of educational objectives can only be reached by using a plurality of means.

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